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Office of Cabinet Affairs

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DRAFT FOR AGENCY REVIEW

Environmental Implications of a Major Oil Spill in the Persian Gulf

Submitted to the National Response Team by the
National Oceanic and Atmospheric Administration (NOAA)

January 27, 1991

At the request of the National Response Team, NOAA ~~examined~~ ^{has conducted a preliminary examination of some} the environmental implications of the major oil spill originating along the coast of Kuwait. This analysis is qualitative in nature, however is based on the assumption that the spill involves several millions of barrels of oil. ^{see below *} The following agencies have been involved in reviewing this document: Department of Defense, Department of Energy, Department of Interior, Environmental Protection Agency, and the U. S. Coast Guard.

1. How will the spill move and spread through the Persian Gulf?

Oil spill movement is driven by the combined force of both winds and surface currents. Winds in the Persian Gulf during January and February are predominantly from the northwest at average velocities of ten miles per hour. Along the east coast of Kuwait and Saudi Arabia the currents flow generally to the south-southwest parallel to the shore at velocities that vary from a few tenths of a knot in the north to just less than a knot in the south.

^{can this be updated?} On the evening of January 25th, the leading edge of the slick had advanced to the south, across the Kuwait border into a region just inside Saudi Arabian waters. The further advance of the oil will depend on weather conditions, however the oil will typically move between 5 and 15 miles a day along the coast of Kuwait, speeding up slightly as it moves south along the coast of Saudi Arabia. As the oil moves south, variable winds would tend to distribute it into a coastal swath that broadens as it moves. Coastal impacts are expected along much of the Kuwaiti and Saudi coast with particularly heavy deposits associated with headlands (Ra's al Quilay'ah, Ra's al Zawr, Ra's al Khaffi, and so on down the coast). Oil will tend to accumulate in coastal embayments (north of Jabail, south of Ra's al Ghar, etc.).

^{*It is preliminary in that it is an early assessment based upon previously gathered data, ~~unwarranted~~ by on site information from the Coast Guard-led team of experts dispatched to the area by the President's Environmental Response Team. This document may be used as background for Departments and Agencies with an interest in the subject but should not be publicly disseminated. All press inquiries should be directed to the National Response Team at (202) -----}

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In the vicinity of Ra's Tanura the flow separates from the shoreline and moves east past Bahrain and Qatar. Under the combined influence of the winds and currents, oil in this area will tend to move toward the southeast and impact the shorelines of northern Bahrain and Qatar. "Cross Gulf" currents in this area have significant mixing effect and previous spills occurring north of Bahrain have resulted in some oil drifting over to the Iranian coastline under the influence of sustained westerly winds. Gulf waters around and south of Bahrain have sluggish circulation that would tend to accumulate floating oil for longer periods. It should be noted however, that previous spills have not entered the area south of Bahrain, and in the absence of sustained strong winds from the north, impacts in this area are not likely.

2 How might desalinization plants in the area be affected?

Much of the drinking water in the region is provided by desalinated water. Kuwait, for example, gets over three-fourths of its water supply from this source. A large percentage of the drinking water for Riyadh comes from desalination plants on the Gulf. The same plants also supply the majority of the power needs for the region. In the early 1980's the Nowruz spill, one of the largest oil spills in history, occurred during the Iran-Iraq war.

omit - seems trivial.
[At that time, it was estimated that an extended summer interruption of power for air conditioning in Kuwait would lead to a large number of fatalities.] *size of spill?*

Relatively small amounts of oil can affect desalinization plant operations. During the Nowruz oil spill in the early 1980's, the Aziziyah desalinization plant in Saudi Arabia was temporarily closed as a precautionary measure because of oil-fouled sediments near its intake. Due to shallow water, the desalinization intakes in many cases are close to the surface.

By the time the spill reaches the larger Saudi plants at Jubail and Khobar, or the ones in Bahrain and Qatar, the oil will have weathered substantially, posing somewhat less risk of contaminating the water supply. The plants in this region have contingency plans that in the past have provided protection of the intakes from floating oil.

3. What natural processes will affect the spill?

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Arabian crude oil varies slightly from field to field, but once released into the environment a number of processes will begin to change the oil's characteristics dramatically. The most important of these processes are evaporation, formation of a water-in-oil emulsion, and sand storms. A small fraction of the oil will also dissolve into the water column. In combination, these processes will result in about half of the oil being removed from the water surface over a period of a two to ten days, depending on the weather. During this period, the density of oil on the surface will increase with the remaining oil being only slightly buoyant.

Larger slicks will tend to disaggregate into small floating patches of oil and tar balls. Along beaches, areas of heavier accumulation will mix with sand and form tar mats similar in consistency to softened asphalt pavement.

Strong winds in the northern Gulf create sand storms that result in very large sand deposition over coastal waters. These tend to be at an extreme during the "shamal" period in spring, but high suspended particulate concentrations are common throughout the year. Sand will settle out on the surface oil slick, increasing the density of the oil such that it could readily sink. Oil reaching the bottom in this manner would do so in a widely scattered form and, unlike the coastal accumulations, not aggregate into tar mats. During the Nowruz spill, large surface slicks did not appear on the surface beyond about six weeks, being removed by evaporation or sunk by sand deposition. Widely scattered tar balls did continue to float for longer periods and occasionally come ashore in isolated patches.

4. How toxic is Arabian crude oil and how does its toxicity vary over time?

Arabian crude oil is of average toxicity when compared with other crude oils from around the world. Acute toxicity to marine organisms is primarily a function of the percentage of low molecular weight compounds in the oil - compounds which are capable of dissolving into the water. This effect is most important only during the early hours and days of the spill.

Dissolved hydrocarbons are, however, generally concentrated near the water's surface and persist only until evaporative processes remove the low molecular weight compounds. In most spills, toxic level of hydrocarbons are confined to the top meter of the water and usually do not persist beyond several hours.

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5. How sensitive are the biological resources of the Persian Gulf to oil spills?

Habitats at risk include coral reefs and seagrass beds; important resources include the dugong (a large, manatee-like marine mammal), sea turtles and shrimp. Several of these populations are classified as endangered species. The most critical habitats in the region include sections of the coastline of Iran and United Arab Emirates, however, these regions are far enough removed from the coast of Kuwait that the oil reaching these areas would be substantially weathered and much reduced in toxicity.

There are small platform coral reefs between Abu Ali Island and Safaniyah off the Saudi Arabian coastline and north of Bahrain and Qatar. Coral reefs will likely survive a large oil spill unless use of dispersants becomes intensive and prolonged. No long term impacts on the coral reefs are evident from past spills in the area. Recent mesocosm studies concluded that healthy reef corals can tolerate relatively short (1 - 5 day) exposure to both fresh floating and dispersed Arabian crude oil with no observable long term (1 year) effects on growth and colonization. Some coral mortality is likely to result if dispersants are used to control the slick over a long period.

Patchy distributions of seagrass beds and mangroves occur all along the Saudi Arabian coastline, in the channels between Saudi Arabia and Bahrain, and between Bahrain and Qatar. These grassbeds provide important habitats for several species of marine life including the commercially harvested penaeid shrimp. While seagrasses could suffer from an impact of fresh crude oil, they have generally quickly recovered after past spills. In 1970, a 100,000 barrel oil spill occurred in Tarut Bay, an area of around 400 sq. km. Tarut Bay contains mud flats, grassbeds, black mangroves and shrimp spawning areas. The spill extended from shore to shore and left large tarmats on the beaches. There are, however, still living mangroves and an active local fishing industry in this area.

Shrimp are one of the most important fisheries in the northwestern Gulf. Shrimp grounds occur off northern Saudi Arabia, and are subject to harvest by foreign industrial trawlers. After reaching peak landings in 1967-68 (17,000 tons), landings declined into the mid-1980's (9,000 tons). Recruitment of shrimp increased in 1982-83, but other information suggests overall recruitment has been declining in the 1980's due to

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environmental degradation, land reclamation in former nursery areas and reduced rate of flow of Shatt Al-Arab waterway. Juvenile shrimp, which presumably occur in seagrass and inshore in heavily vegetated areas, are considerably more susceptible to oil toxicity than adults; stocks may be severely damaged by chronic oiling in these environments. There have been apparently minor impacts to fisheries of past spills. In 1980, a 100,000 barrel oil spill impacted the coast of Bahrain. No long term impacts on the shrimp harvest could be detected. During the Nowruz spill, fishing vessels in the region had nets and catch contaminated by oil, but no significant hydrocarbon residues were detected in the fish population.

Is this?
NOWRUZ?

The dugong lives and feeds along the Gulf coast and ranges all along the Indian Ocean shoreline. Dugong mate in February and March, in shallow water, with a gestation period of 1 year. Their metabolic heat is controlled by blubber and they would likely react to oil more like sea lions than like fur-bearing mammals, such as sea otters. A more serious threat may be physical damage to unseen animals due to boat operations. During the Nowruz spill, there were extensive fatalities, but recent observations have shown a stronger than expected population with 900 animals recorded in one sighting in the Bahrain region.

There may be some risk of damage to recently hatched turtle populations if there is heavy oiling of shorelines during spring on several islands offshore of Saudi Arabia, but the risk of significant damage to adults is low. The green turtle occurs in the Gulf throughout the year, feeding in seagrass beds and the breeding population of the western Gulf may be the source of animals as far east as India. Eighty percent of the Saudi Arabian population of green turtles use Karan Island for breeding. Juveniles can experience high mortality when they migrate across oiled beaches during their release cycle. During the Nowruz spill, there was some turtle mortality on the islands, but the impact was small because turtle nests on the southern half of the islands were somewhat sheltered from oil coming from the north.

There are a few species of seabirds that occur only in the Persian Gulf, some of which breed in the winter season, and others that migrate through the area. There have been incidents of large numbers of oiled seabirds during past spills in the region. Birds have been impacted both by direct oiling and by oil contamination of their food supply. The spill could result in significant impacts to local populations of wide-ranging species. Species that reside only in this area may have their total populations severely reduced.

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DRAFT FOR AGENCY REVIEW*6. What would be the long-term fate of a massive oil spill in this region?*

The marine environmental effects of a major spill in this region are not likely to be long term or irreversible. The long term effects of the Nowruz oil spill appear to have been minimal. The area has been subject to more or less continuous small spills so that background oil pollution levels are high. A 1983 estimate of yearly oil spillage through normal operations was larger than the total amount spilled in the EXXON VALDEZ accident. Because the water is so shallow, the Gulf is flushed quite rapidly for a body of water of its surface area. The estimated flushing time through the Straits of Hormuz is between two and six years. Therefore, the residence time for any pollutant is much shorter than other comparable water bodies such as, for example, the Red Sea.

The first effect would be that certain segments of the Kuwait, Saudi Arabian, Iranian, Bahrain and Qatar coastlines would receive oil impacts in the form of scattered tar balls. Highly likely targets would be the Southern Kuwait coastline, Abu Ali Island, northwestern Bahrain and the northern tip of Qatar. In addition, tar mats could be expected to form along tens of miles of shoreline. The oil would be highly weathered and in a relatively non-active, non-toxic form. Mechanical cleanup of this oil would be relatively straightforward.

The second effect would be that sand laden tar balls would sink to the bottom of the Gulf and become part of the bedload and longer term depositional processes. These sand impregnated tarballs would contain highly weathered and relatively non-toxic components. In previous large spills, benthic trawls have shown that small amounts of hydrocarbons are scattered over wide areas of the bottom of the Persian Gulf, and they have not appeared to lead to abnormalities in the benthic communities.

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AGENCY	POINT OF CONTACT	PHONE	FAX
White House Situation Room		202-395-6313	202-395-5221 Via Wash Fax Secure 202-395-1206
D.O.T.	To be determined		
D.O.E.	John Easton	202-586-4004/8100	202-586-0420
Dept of State	Bob Blumberg	202-647-6614/1554	202-647-6610
DOD Crisis Coordination Center	CG Rep CAPT Healing	703-769-9333	703-697-1920 Secure 703-697-1915
JCS Crisis Action Center	CG REP	703-695-2806	703-697-4801 703-693-5487
USCG Crisis Action Center		703-267-2101	202-267-2181 Secure 202-267-2107
Central Intelligence Agency		703-506-1218	STU III 703-506-1219 703-760-9629
EPA Emergency Ops Center	Jim Makris	202-4575-8600	202-252-0154
USCG Public Affairs..		202-267-0930/31/32	

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It is preliminary in that it is based on preliminary data and an early assessment of the spill. Information from the coastward lead team will be incorporated into the final report. 1. How will the spill move and spread through the Persian Gulf?

Oil spill movement is driven by the combined force of both winds and surface currents. Winds in the Persian Gulf during January and February are predominantly from the northwest at average velocities of ten miles per hour. Along the east coast of Kuwait and Saudi Arabia the currents flow generally to the south-southwest parallel to the shore at velocities that vary from a few tenths of a knot in the north to just less than a knot in the south.

update
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This document may be useful as background information on developments and
~~material~~
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changes to subject to be published
disseminated to all interested parties

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Special Message

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January 30, 1991

NOTE TO Gulf Oil Spill Interagency Group

Capt. Holt suggested distribution to the Group of the following paper for discussion in today's teleconference.

Jim Makris

OECD Ministerial Meeting
Talking Points for Administrator on UN System
Response to the Gulf Oil Spill

Issue: UNEP, in conjunction with IMO and other UN agencies, is developing an oil spill contingency response team in the context of the UNEP Gulf Regional Seas Program. This team will be sent to the Gulf to monitor the environmental damage caused by the oil spill and to produce an international and independent assessment of the current and potential damage and the most effective means to deal with it. According to the Washington Office of UNEP, this UNEP/IMO initiative is acceptable to the eight concerned Gulf states.

o UNEP has created an internal task force, headquartered in Nairobi, to be chaired by Oceans and Coastal Areas Program Director Peter Schroeder.

o UNEP will also be sending a mission to Saudi Arabia which will be headed by Michael Gwynne, Director of the Global Environmental Monitoring System (GEMS) and Mr. Stjepan Keckes, former Director of the Oceans and Coastal Areas Program. The team will look at the scientific and technical information needed to address the damage to the Gulf and to ensure a continuous flow of information about the action.

o In addition, Dr. Tolba has called for a two-day meeting of UN agencies and representatives from major oil companies with interests in the region the week of February 4 in Geneva. This meeting will define the numerous environment-related problems of the Gulf and address the gaps in the information flow in order to develop a process which bridges the gaps.

o Dr. Mostafa Tolba, Executive Director of UNEP, released a statement on January 28, 1991 in which he described his concern regarding the environmental effects of the Gulf war and the UNEP effort. He wants to keep the UN system effort autonomous from any national (e.g., U.S.) or regional (e.g., OECD) initiative.

o IMO has been working to conclude the Oil Pollution Preparedness Response and Cooperation Convention 1990 (OPRC) and has been working to deal on an international level with response to incidents such as the Gulf spill (dump). Were the OPRC to be in force it would be the controlling treaty.

Background: UNEP was given the mandate in 1974, through a treaty establishing the Kuwait Regional Seas Program for the Gulf, to work collectively on a Gulf environmental management system of which a high priority has been oil spill problems and emergency response preparedness. The following Gulf Governments are party to the treaty: Bahrain, Oman, United Arab Emirates, Iraq, Iran, Saudi Arabia, Kuwait and Qatar.

According to the UNEP OCA/PAC project document, severe damage has been occurring to the seabed in the Gulf for many years including the loss of approximately 250,000 tons of shrimp due to the 1983 oil spill. The document also states that approximately one and one-half million tons of debris per year, including oil, has been spewing into the Gulf. In addition, several species in the Gulf region are on the endangered species list and have been affected by oil spills before the current conflict began.

Talking Points:

1. The US looks to Saudi Arabia to direct clean up operations in the Gulf.
2. The US supports the UNEP/IMO initiative as long as it supports the Saudi leadership role in the Gulf clean up effort and does not conflict with the US effort. The US Interagency Assessment Team (USIAT) is performing certain functions to assist the Saudi Government at their request. Any intimation of a parallel effort from any quarter will seriously undermine the USIAT.
3. The UN has passed several resolutions regarding Iraq's invasion of Kuwait. Care should be taken in showing support for the UNEP task force in view of UNEP's statement that their mission will be "non-political".

Clearances

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Source Citation

Iraqi Oil Spill [7], [OA/ID CF00553-012]. n.d. MS Records of the Persian Gulf War: Records of the Persian Gulf War Collection. George H.W. Bush Presidential Library. Archives Unbound, link.gale.com/apps/doc/SC5101215255/GDCS?u=webdemo&sid=bookmark-GDCS&xid=3e8af961&pg=1. Accessed 19 Mar. 2022.

Gale Document Number:GALE|SC5101215255